II. "Notes of Researches on the Acids of the Lactic Series.—No. II. Action of Zinc upon a Mixture of Iodide of Ethyl and Oxalate of Methyl." By EDWARD FRANKLAND, F.R.S., and B. F. DUPPA, Esq. Received December 20, 1864.

In our former communication * on the action of zinc upon a mixture of iodide and oxalate of methyl, we described a process by which the use of the zinc-compounds of the alcohol radicals may be dispensed with in the production of the series of acids which we are now investigating. We then described this process as being conducted at a temperature of 70° to 100° Cent. for twenty-four hours, until the mixture had solidified to a yellowish gum-like mass, which on distillation yielded a mixture of water, alcohol, and the ether of the new acid. Subsequently we have found it more advantageous to continue the operation for a much longer time at a lower temperature, thereby obtaining a crystalline instead of a gum-like product, the former giving a much better result as regards the production of ether.

In the reaction which forms the subject of the present Note, we have proceeded in the following manner. Two atoms of iodide of ethyl were mixed with one of oxalate of methyl and placed in a capacious flask, with zinc in sufficient quantity to be barely covered by the ethereal mixture. We prefer to use zinc which has been employed in a previous operation, as we find it to act not only with greater rapidity, but also at a much lower temperature. The time required for the completion of an operation is about ninety-six hours at a temperature of from 30° to 50° Cent. During the first eighteen or twenty hours no apparent action takes place, the liquid remaining perfectly limpid, and the zinc apparently untouched; but after this period a straw-coloured tint gradually makes its appearance and slowly increases in intensity, until the liquid solidifies to a mass of crystals which scarcely fuse at 50° Cent. The operation may now be considered as ended, although a considerable quantity of the mixed ethers is still unacted upon. Water being now added by slow degrees until it equals three times the volume of the crystalline mass, a copious effervescence takes place; oxalate and oxide of zinc are formed in abundance, whilst, on the application of heat, alcohol, accompanied by a considerable quantity of an ethereal body, distils over along with the iodide of ethyl that has not been acted upon. The addition of water to the distillate effects an approximate separation of the ethereal from the alcoholic portion; the former is then decanted and distilled for the purpose of separating alcohol and iodide of ethyl. When the temperature of ebullition rises to 100° Cent., the liquid left in the retort is placed over chloride of calcium for twelve hours, after which it is again submitted to distillation, when its boiling-point almost immediately rises to 165° Cent.

* Proc. Roy. Soc. vol. xiii. p. 140.

(bar. 29·85 in.), at which temperature the whole of the remaining liquid passes over. Submitted to analysis, this liquid yielded results closely corresponding to the formula

$$C_7 H_{14} O_3.$$

The decomposition of this ether by baryta, described below, proves it to be the methylic ether of an acid of the same composition as leucic acid, with which also it agrees in its fusing-point. The composition of this ether may therefore be thus expressed:—

$$\left\{\begin{array}{l} C^{iv}\left\{\begin{array}{l} C_2H_5 \\ C_2H_5 \\ OH \end{array}\right. \\ C^{iv}\left\{\begin{array}{l} O \\ OCH_3 \end{array}\right. \end{array}\right.$$

Leucate of methyl is a colourless, transparent, and tolerably mobile liquid, possessing a peculiar ethereal odour only remotely resembling leucate of ethyl. It is very sparingly soluble in water, but readily soluble in alcohol or ether. Its specific gravity is ·9896 at 16°·5 C.; it boils at 165° and distils unchanged. A determination of its vapour-density gave the number 4·84, the above formula corresponding to two volumes of vapour (H_2O=2 vols.) requires the number 5·03.

Treated with caustic alkaline bases this ether is readily decomposed, even in the cold, yielding methylic alcohol and a leucate of the base. A quantity of it was thus decomposed with solution of baryta, the excess of the base being afterwards removed. It yielded on evaporation a crystalline mass very soluble in water, alcohol, and ether, and which, on analysis, yielded results closely corresponding with those calculated from the formula of leucate of baryta.

$$C_2^{iv}\left\{\begin{array}{l} (C_2H_5)_2 \\ (C_2H_5)_2 \\ (OH)_2 \end{array}\right.$$

$$C_2^{iv}\left\{\begin{array}{l} O_2 \\ O \\ O \end{array}\right\} Ba$$

When this baryta-salt in aqueous solution is decomposed with the exact amount of sulphuric acid necessary, the liquid filtered off from the sulphate of baryta, and evaporated *in vacuo*, the acid crystallizes magnificently. Professor W. H. Miller has kindly undertaken the determination of the angles of these crystals. They are readily soluble in ether, alcohol, and water. The acid is greasy to the touch, and nearly inodorous. It sublimes readily at 50° C., and slowly even at common temperatures, a small quantity of the acid left on a watch-glass gradually disappearing, though in other respects it is permanent when exposed to the air. It fuses

at 74°·5 C. Numerous analyses furnished the numbers required by the formula

$$\begin{cases} C^{iv}\begin{cases} C_2H_5 \\ C_2H_5 \\ OH \end{cases} \\ C^{iv}\begin{cases} O \\ OH \end{cases} \end{cases}$$

Leucate of silver was made by adding oxide of silver to a hot solution of the acid. After filtration and evaporation *in vacuo*, it crystallizes in brilliant silky fibres adhering closely to the capsule. These are anhydrous, and are scarcely discoloured by prolonged exposure to a temperature of 100° C. They yielded on analysis numbers closely corresponding with those calculated from the formula

$$\begin{cases} C^{iv}\begin{cases} C_2H_5 \\ C_2H_5 \\ OH \end{cases} \\ C^{iv}\begin{cases} O \\ O\,Ag \end{cases} \end{cases}$$

Although this acid possesses the same percentage composition, atomic weight, and fusing-point as the leucic acid obtained by the action of zincethyl upon oxalic ether, yet it does not appear to be identical with that acid. The silver-salt of the latter crystallizes in brilliant needles radiating from centres standing up freely from the capsule, and containing half an atom of water which is not expelled at 100° C. This salt also further differs from that above described by becoming rapidly discoloured when exposed to the heat of a steam-bath. We are at present engaged with a rigorous comparison of the properties of these and other similarly related acids of the lactic series.

III. "Preliminary Note on some Aluminium Compounds." By George Bowdler Buckton, F.R.S., and William Odling, M.B., F.R.S. Received January 12, 1865.

Until recently the molecule of aluminic chloride had always been represented by the formula Al_2Cl_3, or, selecting the high atomic weight of aluminium, as required by its specific heat, $AlCl_3$. But since Deville's determination of the vapour-densities of aluminic and ferric chlorides, many chemists of eminence, both in this country and abroad, have adopted the formula Al_2Cl_6, and have consistently doubled the previously received formulæ for the entire series of aluminic compounds. In our opinion, however, the hitherto existing data seemed hardly sufficient for the definitive establishment of either set of formulæ; and it occurred to us that an examination of the so-called organo-compounds of aluminium might not improbably throw some important light upon the question at issue between them. We regarded the determination of the question as a matter of con-